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Odontomas in developmental age: confocal laser scanning microscopy analysis of a case

ABSTRACT

Background Odontomas are the most common benign odontogenic tumors (especially in children and adolescents) and consist of odontogenic ectomesenchyma and odontogenic epithelium with the formation of dental hard tissues. They are also simply considered hamartomas. The WHO Classification defines them as complex and compound odontomas. The diagnosis is often occasional, in conjunction with x-ray routine examinations, or it is suggested by eruption disorders or abnormal position of teeth in the dental arch. The mainstay therapy is surgical excision of the lesion followed by orthodontic treatment to take in the arch the impacted teeth.

Case report The aim of this work is the presentation of a case of mandibular bilateral compound odontoma in a young patient, and the confocal laser scanning microscopic analysis of the surgical specimens.

Keywords Odontoma; Odontogenic tumors;
Retained teeth; Confocal Laser Scanning Microscopy.

Introduction

Odontomas are the most common odontogenic tumors (34.3% according to Tamme et al. [2004] and 22% according to Veis et al. [2000] and are considered the result

of a defective development of teeth and adjacent structures [Tamme et al., 2004]. The nosological position of odontomas is still under discussion. The first attempt to classify these lesions is attributed to Paul Broca [1868], who, in 1869, coined the term "odontoma" to identify a "neoplasia constituted by an overgrowth of dental tissue". According to the 2005 WHO Classification, odontomas are among benign odontogenic tumors consisting of odontogenic ectomesenchyma and odontogenic epithelium with or without the formation of dental hard tissues, also known as mixed odontogenic tumors [Barnes et al., 2005]. Other authors prefer to consider them hamartomas, because of the presence of unlimited, autonomous and progressive growth, alterations of the structure and prevailing development of one or more components [Tartaro, 1988]. In fact, odontomas are constituted by structures of both epithelial and mesenchymal origin, that undergo complete differentiation into ameloblasts and odontoblasts, with deposition of enamel, dentin, cement and pulp tissue. They can take on the appearance of amorphous masses of dental tissue (complex odontomas, more frequent in the lateral region of the mandible) or may contain single or multiple well formed denticles (compound odontomas, especially located in the intercanine area of the maxilla) [Reichart and Philipsen, 1999]. They usually occur during the development of the permanent teeth and are recognized in the first and second decade, with no sex predilection [Hidalgo-Sánchez et al., 2008; Crincoli et al., 2007; Da Silva et al., 2009; Daley et al., 1994]. These lesions may remain undetected because they are not often associated with clinical signs or symptoms [De Oliveira Bet al., 2001]. Therefore, the diagnosis is often occasional, in conjunction with x-ray routine examinations [Chen et al., 2006], or it is suggested by eruption disorders or abnormal position of teeth in the dental arch [Tomizawa et al., 2005; MacDonald-Jankowski, 1996; Huber et al., 2008; Kavadia-Tsatala, 2004; Batra, 2004; Zoremchhingi, 2004; Hitchin, 1970; Favia, 2005]. Histological examination confirms the presumptive diagnosis [Chiapasco, 2006]. Treatment consists in the complete surgical enucleation of the lesion [Chiapasco, 2006; Brusati and Chiapasco, 1999; SICOI, 2011].

We report a case of a 10-year-old male patient with mandibular compound odontoma treated in the Department of Pedodontics, U.O.C. of Dentistry, University of Bari. The specimens were observed by optical microscope and by Confocal Laser Scanning Microscope (CLSM).

Case report

The patient L.M., a 10-year-old boy, was referred to the U.O.C. of Dentistry, University of Bari (Italy) in April 2012.

The clinical intraoral examination showed the persistence in the arch of teeth 7.4 and 8.4. Radiographic analysis revealed two symmetrical radiopaque masses with a surrounding thin radiotransparent halo, up to the first lower premolars (Fig. 1), compatible with the diagnosis of



FIG. 1 OPT showing two symmetrical radioopaque masses with surrounding thin radiotransparent halo, up to the first lower premolars.

FIG. 2



FIG. 3



FIG. 4

FIGS. 2, 3, 4 Phases of the enucleation of the lesions.

compound bilateral Odontoma.

The enucleation of the lesions was planned, in a single operative session. It was performed: infiltration of carbocaine-based local anesthetic with vasoconstrictor (adrenaline 1:100,000), avulsion of the deciduous tooth, incision and dissection of a mucoperiosteal flap, ostectomy with specific inserts for piezoelectric scalpel, enucleation of the calcified masses and their connective tissue capsule, toilette of the remaining surgical cavity, irrigation with saline, repositioning of the flap and suture in Vicryl 4/0 (Fig.2-3-4). The specimens were fixed in a buffered solution of 10% formalin, embedded in paraffin, cut in 3µm thick serial sections, stained with hematoxylin-eosin, by optical microscope and by Confocal Laser Scanning Microscope (CLSM) in autofluorescence. CLSM analysis was obtained with a Nikon Eclipse E600 optical microscope with a C1 laser scanning system, with the following configuration: argon and helium-neon lasers generating light at respectively 488 and 543 nm wavelengths. For each specimen we acquired 10 bi-dimensional images using pinhole of small size (30 µm) and Nikon Plan Fluor 20x/0,50 lens. EZ C1 software was used for the confocal analysis. Images were saved in TIFF format and stored on PC hard disk.

The 2-week checkup showed excellent healing of the tissues (Fig. 5). The follow-up at 6 months showed the absence of recurrence and the eruption of the previously retained teeth (Fig. 6), confirming the role of odontoma of obstacle to physiological eruptive process.

Discussion

The clinical case highlights the correlation of odontomas with eruption disorders and the importance of early diagnosis and enucleation. The sections, stained with hematoxylin-eosin and observed by optical microscope, showed the presence of dental hard tissues forming rudimentary denticles, a basophilic calcified tissue composed of dysplastic oligocellulare cement with varying degrees of calcification, incremental lines and dentinal tissue (Fig. 7, 8). CLSM analysis in autofluorescence underlined a different fluorescence of soft and hard



FIG. 5
Checkup at two weeks.



FIG. 6
Checkup at 6 months.

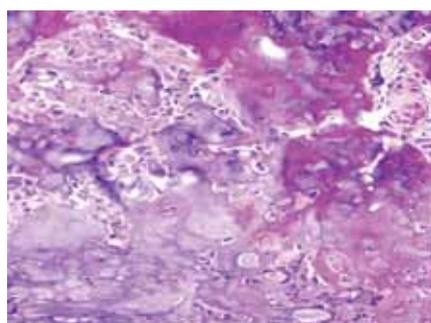
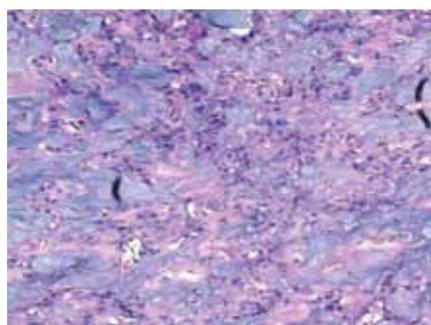


FIG. 7, 8
Histological examination of the sections, stained with hematoxylin-eosin and observed by optical microscope.



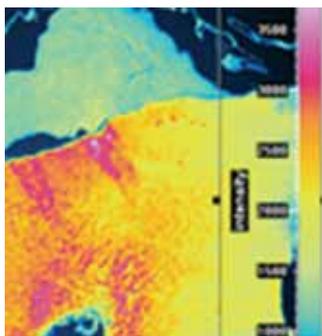


FIG. 9 CLSM analysis in autofluorescence.

tissues showing different intensity of emission in autofluorescence due to different degrees of calcification (Fig. 9). The odontogenetic components appeared strongly autofluorescent and presented foci of ectomesenchymal dentinogenetic multifocal differentiation that cause irregularities in the shape and structure of the tissue. CLSM analysis showed well-defined follicular area entrapped in hard tissues and pointed out ghost-cells, otherwise not identifiable by traditional microscopy. They are organised in small eosinophilic islands and appear squamous in shape, with central clear areas (representing the nucleus), which indicates karyolysis.

Epithelial ghost cells, or shadow cells, can be found in the calcifying epithelioma of Malherbe and in the calcifying and keratinising epithelial odontogenic cyst, too. In our study, CLSM analysis showed the presence of these cells in odontomas, demonstrated only by a restricted number of significant studies [Levy, 1973; Zucker and Prince, 1999; Watson, 1999; Crincoli et al., 2007]. Levy et al. [1973] showed in their study that 8 of 43 odontomas contained epithelial ghost cells (nearly 20%). The proximity of the ghost cells to calcified tissues (dentin and enamel) prompts speculation on the pathogenesis of these cells. They are most likely derived from odontogenic epithelium. They are probably not indicative of either cyst formation or neoplasia, since no actively proliferating epithelium was seen in the sections.

As shown by Levy, odontomas grow in a disorderly fashion. As dentin and enamel form and calcify, enamel epithelium may possibly become surrounded and walled off from its blood supply. With a lowered supply of oxygen, squamous metaplasia is a likely occurrence. If oxygen tension continues to decrease, cell death and keratinization are possible, producing the ghost cells. The basophilic lines of calcification indicating dystrophic calcification seems to lend credence to this theory [Levy, 1973].

Conclusion

Odontomas are frequent in childhood and are often responsible for dental retentions and malocclusions.

The clinical and radiographic monitoring of patients as young as 6 years of age allows us to implement interceptive procedure which promote dental eruption according

to physiological criteria. The intervention, in addition to enucleate the lesions, shall be directed to the recovery in the arch of any impacted teeth and to the treatment of malocclusions, in consideration of the psychological effects and functional negative they entail. CLSM allows a careful morphological and histological analysis of odontomas. The morpho-structural organization of the cellular component is observed, with the possibility of three-dimensional reconstruction, so to improve diagnosis and histopathological analysis.

Competing Interest

Authors declare no competing interest.

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